

THE ZOOLOGIST.

THIRD SERIES.

VOL. X.]

FEBRUARY, 1886.

[No. 110.]

ON THE GENUS *HÆMATOPUS* OR OYSTERCATCHERS.

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BRITISH ornithologists are too apt to limit their interest in birds to those of their native country, and thus to miss many of the great lessons which a broader view of the subject teaches. The study of any local fauna is a subject of great interest, but the interest is multiplied tenfold when the details collected in the course of such study are compared with those observed in other countries. The study of a part can never be so instructive as the study of a whole, and though life is not long enough for any one man to master the whole of such a complicated subject as the ornithology of the entire world, every ornithologist should monograph at least a few genera, to obtain some little insight into the wide field of knowledge which such a task opens to the view.

The Oystercatchers are a small compact group of birds, very closely connected with each other, and very clearly differentiated from all other groups of birds. They present another peculiarity, which makes them additionally interesting—they are almost cosmopolitan in their range. They are strictly shore birds, but they do not confine themselves to the sea-shore. They frequent the margins of lakes, the banks of great rivers, and are occasionally seen in other localities inland during migration. Some species are migratory, others resident, whilst some are migratory in one part of their range, and sedentary in another part. They are

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semi-arctic birds, the limit of their northern range corresponding to a considerable extent with the isothermal lines. In North-west Europe, where the influence of the Gulf Stream raises the latitude of suitable climate, Oystercatchers breed as far north as lat. 70° , in East Russia and West Siberia up to 66° , but in East Siberia and on the American Continent only up to about 60° . In the Southern Hemisphere the southern limit of their breeding range is determined by the limitation of the land. No Oystercatcher is known to breed within the Tropics on the mainland, but there is reason to believe that they breed on some of the islands within the Tropics, the Bahamas, the Galapagos Islands, the islands on the north coast of Australia, and possibly elsewhere; otherwise Oystercatchers are only winter visitors to the tropics.

The Oystercatchers constitute the genus *Hæmatopus*, which belongs to the family *Charadriidæ*, a group of birds which also includes the Sandpipers, Snipes, Plovers, Turnstones, &c. Some ornithologists split this family into two, *Charadriidæ* and *Scolopacidæ*, but the Oystercatchers are witnesses against the evidence of such a course. It is impossible to decide in which of the two pseudo-families they should be placed. The American ornithologists (whose practice of splitting amounts almost to a monomania) cut the Gordian knot by placing the Oystercatchers in a family by themselves, which they call *Hæmatopodidæ*!

In the family of *Charadriidæ* the scutellations of the tarsus vary to a remarkable degree. In some species the tarsus is covered both in front and at the back with broad scutellations, the front row being connected with the back row by fine reticulations which cover the side of the tarsus. In other species the front row of scutellated plates alone is present, the back of the tarsus as well as the sides being covered with fine reticulations; whilst in a third group the fine reticulations extend all round the tarsus. These three groups are obviously purely artificial ones, and are open to another serious objection. They are not separated from each other by a hard-and-fast line, but many genera include forms which are intermediate between one and the other. Nothing of this kind, however, occurs in the Oystercatchers; they all clearly and undoubtedly belong to the third category, in which the whole of the tarsus is covered by a fine network of small

hexagonal reticulations. To this group belong also the Red-billed Curlew (*Ibidorhynchus*), the Stone Curlews (*Ædicnemus*), the Stilts and Avocets (*Himantopus*), and some of the Plovers (*Charadrius*). To distinguish the genus *Hæmatopus* from these genera it is necessary to take into consideration two other characters. Compared with the Stilts, Stone Curlews, and Plovers, the Oystercatchers have long bills and short legs, so that the character of bill longer than tarsus effectually excludes these birds. It does not, however, exclude some of the Avocets, with their slender recurved bills, or the Red-billed Curlew, with a bill decurved like that of an Ibis. The clumsy, nearly straight bill of the Oystercatchers distinguishes them from these birds. In spite, however, of the extraordinary fact that it possesses a bill of such a totally different shape from that of an Oystercatcher, there can be no doubt that the Red-billed Curlew is the nearest surviving relative of the Oystercatchers. It is, in fact, nothing but an Oystercatcher with a modified bill. The bill of the Oystercatchers is very abnormal. Most birds have beautiful bills remarkable for the subtlety of their curves, but the bill of the Oystercatchers can only be regarded by an artist as "sadly out of drawing." The diagnosis of the genus *Hæmatopus* will therefore stand as follows:—

Charadriidæ, with a nearly straight bill, longer than the tarsus, which is reticulated all round. Each of these three characters may be found in other birds of this family, but no birds belonging to it combine all three characters, except the Oystercatchers.

There is abundant evidence in support of the hypothesis that the centre of dispersion of the *Charadriidæ* was the North Pole; that the Oystercatchers were originally residents on the shores of the Polar Sea, whence they were dispersed and driven southwards by the arctic ice which formed and reformed during the Glacial Epoch. Isolated on various distant shores, the consequences of isolation soon appeared and differentiated the Oystercatchers into several specific and subspecific forms. It is very interesting to trace their wanderings and to note their specific differences, which agree in a remarkable manner with the hypothesis of their polar origin and with their present geographical distribution, although the latter bears no sort of relation with the geographical regions laid down by Messrs. Sclater and Wallace, which refer to pas-

serine birds, but are seldom recognised by those belonging to other families.

The descent of an arctic climate upon the North Polar regions soon drove the residents of the Polar basin into more southern latitudes. Coast-birds like the Oystercatchers could escape by four routes. They could either follow the European or the American shores of the Atlantic, or the Asiatic or American shores of the Pacific. If they availed themselves of all four routes, the emigrants would soon become isolated in four colonies, which would eventually produce four species or groups of species. Behring's Straits lies 25° south of the Pole, and the Asiatic coast is connected by a row of islands with the Pacific coast as far as 40° from the Pole, so that isolation and consequently differentiation would begin late with the Pacific birds; whilst in the Atlantic the emigrants would probably be effectually isolated for ever by Greenland's icy mountains at a distance of not more than 5° or 7° from the Pole. It would therefore be reasonable to expect that the Pacific Oystercatchers would be much nearer allied to each other than the Atlantic Oystercatchers are.

Let us now examine the peculiarities and geographical distribution of each species, and see how far our theories are supported by facts.

1. *Hæmatopus palliatus*. — The North American Pied Oystercatcher, like *all* the other Oystercatchers, has the entire head and neck nearly black, and the bill red. It resembles *all* the *Pied* Oystercatchers in having the greater wing-coverts, the upper tail-coverts, a considerable part of the secondaries, and the under parts below the neck, white. Further, it agrees with *all* the Oystercatchers of the *New World* in having pale flesh-coloured legs. Its specific character consists in having the rest of the plumage (*i.e.*, the upper parts below the neck, with the exception of the greater wing-coverts and the upper tail-coverts) brown.

Leaving Greenland to the left, the ancestors of the North American Pied Oystercatchers probably retreated from the Polar ice down Baffin's Bay, and gradually extending their range southwards along the Atlantic coast of North and South America, rounded Cape Horn, and turning northwards again along the Pacific coast of South America their descendants have extended their range northwards as far as Lower California, which appears

to be the present limit of the emigration of this party. Their route precisely corresponds (so far as is known) with the present range of this species, except that it is not now found north of Labrador.

2. *Hæmatopus leucopus*. — The Falkland Island Pied Oystercatcher principally differs from its more wide-spread ally in having the brown parts replaced by black. Its range extends from the Falkland Islands and the islands in the Straits of Magellan to those on the south-west coast of Patagonia. This species is unquestionably an offshoot of the preceding species, which has become differentiated in consequence of its having become isolated on the Falkland Islands, whence it probably spread later to the islands off the Patagonian coast.

These two species represent the Atlantic New World group of Oystercatchers, which may be characterised as having flesh-coloured legs, white lower under parts, and dark rump.

3. *Hæmatopus niger*.* — The North American Black Oystercatcher, like all the Oystercatchers of the New World, has pale flesh-coloured legs, but, like all the Oystercatchers which passed through the Behring Sea, the whole of its plumage has become black. This species is a summer visitor to the Aleutian Islands and the southern shores of Alaska, breeding as far south as the coast of Upper California, where it is probably a resident, and wintering on the coast of Lower California.

4. *Hæmatopus niger ater*. — The South American Black Oystercatcher only differs from its more northern ally in having generally a shorter and deeper bill. Examples in my collection of the northern form have bills $3\frac{1}{4}$ inches in length and 0.5 in. in depth, whilst others from Chili have bills $2\frac{3}{4}$ in. in length and 0.6 in. in depth. It is said, however, that in a series of each the dimensions are found to overlap, so that the American ornithologists very justly regard the two forms as only subspecifically distinct. This form is evidently the result of an emigration from the range of the preceding species, which has caused a colony to cross the Tropics and establish themselves as residents on the coasts of Chili, Patagonia, and the Falkland Islands; but the

* Pallas described this species as inhabiting the Kurile Islands. It certainly does not do so now. The great Russian traveller may have been deceived, or it is possible that a stray bird had been driven across the Pacific from Alaska by a storm.

isolation of the two colonies thus produced does not appear to have lasted quite long enough for the complete differentiation of the two forms.

These two forms represent the Pacific New World group of Oystercatchers, which may be characterised as having the whole of the plumage black, and the legs flesh-coloured.

5. *Hæmatopus unicolor*.—We have attempted to trace the history of the American detachment of Oystercatchers, and we must now try and follow the fortunes of the other portion which retreated along the shores of the Old World. The two American parties found a comparatively restricted coast-line at their disposal, and both of them seem to have been glad enough to retrace their steps, after the glacial climate had passed away, almost to the entrance of the Polar Sea. The Asiatic party, on the other hand, found a practically unlimited extent of coast-line suitable to their requirements. They seem to have had room and to spare in Australia, South Africa, and on some of the numerous islands in the southern half of the Eastern Hemisphere; consequently they have never had occasion to recross the line to occupy once more their old route of emigration on the Pacific coast of Asia. But although they have wandered to the other side of the world, the fact that the two Pacific parties travelled in company for more than two thousand miles further than the two Atlantic parties could have done has produced precisely the results which we anticipated. The Pacific Old World Oystercatchers scarcely differ from the Pacific New World Oystercatchers in anything beyond the colour of their legs. The Australian Black Oystercatcher resembles its American cousin in having the whole of its plumage black; but the basal half of the bill is slightly more elongated, and the colour of the legs and feet are brick-red, instead of pale flesh-colour. It is a resident throughout the coasts of New Zealand, Australia, and Tasmania.

6. *Hæmatopus unicolor capensis*.—Instead of retracing their steps to the Behring Sea, the surplus population of the Australian Black Oystercatchers appear to have emigrated westwards to South Africa. The African Black Oystercatcher is so closely allied to its Australian representative that many ornithologists do not discriminate between them. It may, however, be recognised by its shorter bill, the basal half of which is not exceptionally elongated, and by the colour of its legs and feet, which are not

brick-red, but deep crimson. It can scarcely be regarded as more than subspecifically distinct from the Australian form. It is distributed along the entire coast of South Africa, ranging as far north as the Canary Islands in the west, and into the Red Sea in the east. It probably breeds south of the line, only wandering northwards in the autumn (about March).

These two forms represent the Pacific Old World group of Oystercatchers, which may be characterised as having the whole of the plumage black, and the legs red.

7. *Hæmatopus ostralegus*.—As has already been suggested, we find that the East and West Atlantic Oystercatchers differ more from each other than the East and West Pacific ones do. The European Oystercatcher differs from the North American Pied Oystercatcher in many important particulars besides the colour of its legs. Like all the Old World Oystercatchers, it has red legs—perhaps dull crimson expresses the exact shade of red. The under parts are precisely like those of its ally, but its lower back, rump, and upper tail-coverts are white, whereas in the latter the upper tail-coverts only are white.

In treating of the Pacific Oystercatchers we found that the difference in the conformation of the land in the Old World from that in the New World caused the emigration of the two parties to proceed on different lines. Precisely the same difference is to be found in the distribution of the two Atlantic parties, owing to the same cause. The distribution of the European Oystercatcher, to quote from my 'History of British Birds,' is as follows:—

“The West Palæarctic species ranges from the Atlantic to the valley of the Obb. In the western portion of its distribution it is almost exclusively a sea-shore bird, but east of the Black and White Seas it is only found during the breeding-season on the shores of lakes and rivers. It is a regular summer visitor to the coasts of North-west Europe as far north as land extends, and as far east as Archangel; but further east it is no longer found on the sea-shore, and ascends the Volga and the Kama, crossing over to the Petchora, on the banks of which river, as also on those of the Obb, it only ranges as far north as the Arctic circle. It is a summer visitor to the shores of the Baltic, but on the coasts of North Germany, Great Britain, and France it is a resident. In the basin of the Mediterranean it is principally known as passing

through on spring and autumn migration ; but a few remain to breed in the delta of the Rhone and on the Adriatic coast, where also a few remain during winter. It winters on both coasts of Africa, on the west as far south as Senegambia, and on the east as far south as Mozambique. It is a resident in the Caucasus, but to the valleys of the Don and the Volga, and to the lakes and rivers of Western Siberia and Turkestan, it is a summer visitor, wintering on the Mekran coast and the west coasts of India as far south as Ceylon."

The West Coast of Africa south of Morocco appears to have been of such a desert character that the Oystercatchers were afraid to emigrate further in that direction. The basin of the Mediterranean, on the other hand, provided the necessary outlet for the surplus population, and the stream of emigration continued to flow eastwards from sea to sea, lake to lake, and river to river, at least as far as the Obb. The advanced party appear to have pushed forward still more to the east, and to have reached the valley of the Amoor, whence they never returned, but, following the course of that river to its mouth, they established an independent colony. The cessation of interbreeding between the birds of this colony and the parent stock soon caused a variation between them, and the eastern birds are now generally regarded as specifically distinct, but the difference, though constant, is very slight.

8. *Hæmatopus osculans*. — The Japanese Oystercatcher only differs from the British species, with which we are familiar, in having on an average a longer bill, in having the upper tail-coverts more constantly tipped with black, and in having much less white on the wings. The white on the outside web of the primaries does not appear until the sixth quill, and on the inside web not until the second quill ; whereas in the European bird the white on the outside web appears on the third quill, and that on the inside web on the first. The range of the Japanese Oystercatcher extends for perhaps a hundred miles up the Amoor, and northwards to the shores of the sea of Okotsk, between East Siberia and Kamschatka. Southwards it reaches the shores of North China, and in winter those of South China. They still appear to retain some tradition of their western origin, and occasionally a bird will attempt to find its way back again across country, and appear as an unwonted visitor in Burma or Arrakan.

8. *Hæmatopus longirostris*. — Probably the same catastrophe which drove the Japanese Oystercatcher to the east, an unusually late cold spring, induced a second party to start from the winter quarters in Ceylon, in order to emigrate in a different direction in search of more advantageous breeding grounds, which they appear to have found in Australia. The Australian Pied Oystercatcher differs somewhat more from our birds than its Japanese ally. Both the eastern birds have light red legs, but the Australian species has lost all trace of white on its primaries, and the black of the mantle extends some distance on the lower back.

This species is a resident on the coasts of New Zealand, Tasmania, and Australia, but does not range further north than the southern shores of New Guinea and to other islands immediately to the north of Australia.

These three species represent the group of Oystercatchers which emigrated along the Atlantic coast of the Old World, and may be characterised as having red legs and white rump, as well as white lower under parts.

This completes the list of Oystercatchers, a group of birds whose peculiarities of colour and whose geographical distribution bear unmistakable evidence of the Glacial Epoch almost as obvious as the geological evidence. We can trace almost with certainty the routes which the various parties took on their emigration from the shores of the Polar basin. The great invasion of Europe by Pallas's Sand Grouse in 1863 is almost the only instance of sudden migration which the present generation of ornithologists have witnessed, but the gradual extension of the breeding areas of many species of birds has been remarked over and over again. As regards the Oystercatchers, it seems to me that we can almost trace their history from the origin of the genus in the small area of the Polar basin, until it has become almost cosmopolitan in its range.

VOYAGE OF THE 'ECLIPSE' TO THE GREENLAND SEAS,
CAPT. DAVID GRAY, COMMANDER.

[Mr. Robert Gray, who sails with his father, Capt. David Gray, in the capacity of first mate, has kindly allowed me to send you for publication the following extracts from his private log of the voyage made last year (1885), which I think will be found of interest to some of your readers. Capt. Gray, who has had many years' experience in the Greenland Seas, and is I believe the fourth generation of a family of successful Whalers, has made some valuable contributions to the natural history of the Right Whale, also of the Bottle-nose, *Hyperoodon rostratus*, and was mainly instrumental in obtaining the present close time for Seals, a further extension of which he is now endeavouring to procure.—THOMAS SOUTHWELL.]

THE 'Eclipse' left Peterhead on March 3rd, and Lerwick on March 12th. A great many birds were seen in Bressa Sound, Gulls, Kittiwakes, and a few Dovekies, or Black Guillemots.

March 13th. Noon, lat. $62^{\circ} 33' N.$, long. $1^{\circ} 0' W.$; wind N.N.W. A few "Mallemauks" (Fulmars) and a number of Gulls seen.

14th. Noon, $65^{\circ} 23' N.$, $0^{\circ} 2' W.$; wind W.N.W., force 7.* Numbers of Mallemauks (Fulmars), and a few Rotches (Little Auks) seen.

15th. Noon, $66^{\circ} 55' N.$, $0^{\circ} 30' W.$; wind W.N.W. Several "schools" of Bottle-nose Whales seen going N.E. Mallemauks and Kittiwakes numerous all day; Looms (Guillemots), Rotches, and one or two Dovekies. Crossed the Arctic Circle.

16th. $69^{\circ} 22' N.$, $0^{\circ} 32' E.$; wind W.N.W., force 8; temperature of air 34° . Aurora Borealis very brilliant. "Some six or seven Snow-birds (Ivory Gulls) were noticed in the afternoon, and as these birds are seldom seen far from ice their appearance was considered significant of its neighbourhood, but we afterwards found that they were nearly 130 miles from the nearest ice; their presence therefore could only be explained by the prevalence of strong westerly winds."

21st. $68^{\circ} 24'$, $1^{\circ} 49' W.$, force 8; air 15° , sea 35° . One Finner and two Bottle-nose Whales, also Rotches, Looms, Mallemauks, and Kittiwakes seen. Some birds and Bottle-noses seen daily on 22nd and 23rd.

* The strength of the wind is according to Beaufort's scale.

24th. 70° 30' N., 4° 15' W.; wind W., force 3; air 28°, sea 30°. The edge of the main ice in sight. "The first good day since leaving Lerwick." "A number of Bottle-noses seen to-day; some very large bulls, and *one female with sucker.*"

29th. 72° 50', 2° 45' E.; wind S.W. by S., force 5; air 55°, sea 31°. Passed one Seal on a piece of ice.

30th. 73° 48', 5° 28' E.; wind N.N.E., force 8; air 16°, sea 29°. "Early this morning a Raven came near the ship, and for a few minutes hovered over so close that we could easily distinguish the open spaces between the primaries of the wings."

On 30th four mock suns seen. The whole month of March was a constant succession of gales, more or less severe, and bad weather of all sorts with tremendous seas. The air temperature was 15° on the 22nd (sea 34°); the temperature of the sea varied from 28° to 35° as the ship stood on and off the ice; lowest barometer 28° 7' on the 26th.

April 1st to 3rd. Bad weather continued on the 1st; the barometer fell to 27° 82' before a S.W. gale. On 3rd steamed into the ice, "reaching smooth water and shelter for the first time since leaving Lerwick, a period of twenty-two days, during which time we have had to lie to for gales of wind eight different times."

3rd to 16th. The 'Eclipse' virtually missed the young sealing, owing to the weather she had encountered, and went N.W. to shoot old Seals.

17th to 20th. Between 77° 20' N., 2° 15' E., and 78° 5' N., 0° 0' long. Many Seals and Narwhals were seen, with Looms (Guillemots), Rotches (Little Auks), Dovekies (Black Guillemots), Snow-birds (Ivory Gulls), Burgomasters, and Mallemauks (Fulmars); prevailing winds S. and S.W.

May 2nd. 74° 30' N., 10° 0' W.; wind N., force 3; air 23°, sea 29°. "This forenoon a large bird was seen a short distance from the ship, much larger than the Burgomaster, our largest Gull, most probably one of the Albatross family."*

16th. 78° 10' N., 3° 10' E.; light southerly air; air 23°,

* On the 15th June, 1878, in lat. 80° 11' N., long. 4° E., Capt. Gray shot an Albatross, said by Mr. Sim, of Aberdeen ('Land and Water,' vol. xxvi. (1878), p. 331), to be a Black-browed Albatross (*Diomedea melanophrys*, Temm.), which is now preserved in the Peterhead Museum.—T. S.

sea 29°. The land of Spitzbergen seen at night, heading E. Many birds and a few Narwhals seen.

18th. 79° 6' N., 4° 27' E.; wind S.W.; light air 29°, sea 31°. Rotches and Looms very numerous, and water very greasy.

19th to 22nd. Vast numbers of Looms, Rotches, and Mallemauks, numbers of Dovekies, and a few Eider Ducks, Snowbirds, Burgomasters, and a Puffin.

27th. 79° 44' N., 3° 16' E.; calm. At 5 p.m. reached the edge of the Polar barrier, a vast expanse of frozen pack, over which no water was to be seen to the northward.

June 5th to 11th. A Snow-bird caught fed from the hand on the second day. On the 6th three Bears were seen; also a flock of Brent Geese, five of which were shot by the 'Hope.' Numbers of Looms and Narwhals.

17th. A Beluga or White Whale seen; very unusual in these waters.

20th. Many Hooded Seals were seen, and 250 shot on the stream-ice. "Unlike the other *Pinnipedia*, they do not hesitate to give battle, and await the approach of a boatful of men with apparent indifference. When attacked this Seal inflates his hood, which acts as a helmet, then rearing himself majestically he prepares to give battle when discretion would be the better part of valour. It seems remarkable that this animal should have preserved his valour in spite of from fifty to sixty years persecution."

23rd. 73° 8' N., 11° 49' W. "Floe-rats" (*P. hispida*) numerous, and foot-prints of Bears seen on the floe, the sea containing much Whales' food. The colour of the water most frequented by Whales is green, from pea- and olive-green to green shaded with blue and sometimes peacock-blue. Whales always prefer the parts of the ocean most rich with food where suitable ice is; these spots they seem to search for and there congregate. The presence of Whales is often indicated by their "blowings"—that is, mucus discharged from their blow-holes. Blowings recently discharged shed a film of grease around on the water, and a peculiar smell accompanies them. The blowings of "Finners" differ from those of the "Right Whale"; they present the appearance of long streaks of yellowish stringy matter, easily distinguished from the mucus discharged by the *Mystecetus*, which generally lies in detached spots, and has not

such a coarse appearance. "Greasy water" is caused either by the Whales themselves, by Narwhals, or by the presence of small Crustacea in the water. "In fine weather, when the sea is smooth, a person looking over the ship's side as she is either sailing slowly along, or lying still upon the water, will have his attention attracted by the frequent appearance of particles of oil rising to the surface, spreading out and displaying the usual prismatic colours. This phenomenon is caused by the presence of the various organisms which constitute 'whales' food,' and to it is due the vast sheets of oil which sometimes cover the sea for many miles, evidence of the extraordinary richness in animal life of some parts of the Greenland seas."—R. G.

24th to 30th. Weather calm and fine; winds variable; temperature of air from 29° to 36°, sea 32° to 34°. Many Bears seen, some killed. Narwhals also numerous, one killed by the 'Erik' had *both tusks* developed; large "Finners" (*B. Sibbaldii*) frequently seen. Hooded Seals frequent, and every piece of ice covered with "Floe-rats" (*P. hispida*). The 29th was "a most beautiful morning, not a breath of wind ruffled the mirror-like surface of the water. Numbers of Narwhals and 'Floe-rats' played about, and sometimes one of the great 'Finners' would come suddenly along, rise once or twice to the surface, and continuing his course soon be lost to view. A great many birds—Looms, Rotches, Dovekies, Snow-birds, Burgomasters, Kittiwakes, and Mallymauks—flying hither and thither, some alighting on the ice, others diving for food. Now and again a prowling Bear would be noticed coming along, either stalking about in an aimless manner or watching a Seal. On the 30th many 'Finners,' Narwhals, and a Greenland Shark were seen."

July. All the month spent cruising in search of Whales. Prevailing winds from the eastward; average temperature of the air 33°, sea 34°; much fog. East coast of Greenland occasionally in sight. Birds numerous, also Hooded Seals, Floe-rats, Finners, and Narwhals; the latter were observed *accompanied by young ones*.

August 1st. Light N.E. wind and fog. When clear coast showing high and bold from Shannon Island southward. With the exception of a few Ground Seals, *Phoca barbata*, the sea containing remarkably little life. Very few birds seen either this day or on the 2nd in 73° 38' N., 17° 46' W., when

the land was visible from Shannon Island to Cape Hold-with-Hope.

3rd. $72^{\circ} 50' N.$, $16^{\circ} 15' W.$; calm light air from W. The character of the water changed, and life became at once abundant. Narwhals, Seals, and Bears seen, and a Walrus shot, which had been feeding on Seals. Bay-ice beginning to form, and pools of fresh water frozen over.

6th. $71^{\circ} 5' N.$, $18^{\circ} 34' W.$; calm and fine. Steamed S.W. towards the entrance of Scoresby's Fiord until stopped by ice; coast very grand, fine precipices and glaciers. Scoresby estimates the average height at 3000 feet. Rotches in clouds; "they are already coming off the land accompanied by their young." From this point the 'Eclipse' headed for home, reaching Peterhead on the 17th August.

THE PROBLEM OF THE SOARING BIRD.

BY J. LANCASTER.*

It is now more than two years since I first made known the results of investigations on the methods of flight of the great soaring birds, carried on at intervals since 1850. The Whooping Cranes of the north-west, performing their migrations on motionless wings, had at that early date fixed my attention, and my times of leisure down to 1876 were devoted to ransacking the scientific and literary world, and to observing the birds in the act whenever it was possible to do so, that I might get an explanation of the phenomenon of more substantial character than mere guesswork. Plenty of assumed solutions were found scattered about. Such theologians as I consulted were confident that the question had reached its lowest terms when it was said that "God had created the birds to fly." Common-sense folks rejected the idea of fixed wings, and held to a slow flapping that could not be seen, while the scientists were confident of upward slanting currents of air and various atmospheric disturbances which produced the result. Accounts of travellers as to the facts were hopelessly confused, with a single exception, that of Charles Darwin, in his 'Naturalist's Voyage around the World.' His

* From 'The American Naturalist,' 1885, pp. 1055—1058; 1162—1171.

solution of the matter, that of the surging head, was given provisionally.

I was not prepared to deny any of the solutions given, and not more ready to admit them, being conscious of very much ignorance of the entire matter. Meanwhile my interest in the subject, constantly increasing, had, in 1876, overshadowed all others, and being disengaged from business, I devoted the ensuing five years to the birds on the Gulf Coast of South Florida, where the soaring varieties were found in abundance, fully intending to unravel the case before leaving it. The task was a hard one, and the final solution was found in a totally unexpected direction. The predominant feeling I have since experienced in regard to it is one of surprise—surprise that in this ceaselessly active age mechanical possibilities of the most important character could exist in the atmospheric spaces all about us, with many of the largest species of existing birds putting them in daily practice before our eyes, and we still remaining completely ignorant of them! I propose in this paper to present, first, a few of the most significant facts exhibited by the soaring birds; next, to offer an explanation of the phenomenon; and finally, to examine the bearing of what has been said on the problem of artificial air-navigation.

I mean by a "soaring bird" one which habitually travels the air on motionless wings. All birds flap their pinions at times, and many of the smaller kinds, such as Rooks, Kestrels, Crows, and Gulls can maintain flight on fixed wings when the conditions are favourable. But I would never think of observing them for lessons in soaring. They are too light to average the inequalities in the air current, and there are frequently long intervals of active wings before the fixed conditions occur. The soaring varieties are at it all the time. The Frigate-birds live in the air night and day for a week at a time without touching a roost. Their congeners, the Buzzards, spend the day in the same style. The various Cranes common to the coast often spend hours resting in the air, while the Gannet is an admirable soaring bird with a heavy body and relatively small expanse of wings.

When I speak of "fixed" or "motionless" wings the meaning is that no muscular power is used to either overcome weight or air resistance. It is not meant that the pinions are absolutely rigid, like a board, for they are moved to accomplish change

both in shape and position. But they do precisely resemble a board so far as the exertion of motive power is concerned. For instance, if a bird floats in a wind of unvarying velocity over any fixed point on the earth, then if a board of the same shape and size and weight were put in its place it would remain there just as the bird does, as long as the conditions were unchanged. If the bird slightly changed the shape or position of its surfaces so as to vertically ascend indefinitely, the board would also ascend in the same way were it to be changed in a similar manner.

This is seen in the performances of what I have termed "effigies." They were surfaces of veneer or cardboard fastened to a frame and balanced by a weighted pendant. They would simulate the actions of "soaring" perfectly. I have made numbers of them. They would leave the hand and travel against the wind for as much as 500 yards, remaining up for fifteen minutes. They had no ability to automatically balance themselves in unsteady currents of air, but they were good illustrations of "soaring."

The first thing to be definitely ascertained was whether the wings of the soaring birds were in fact as motionless as they seemed. To determine this point demanded close inspection, and although the creatures were not fearful of man in that remote country, they preferred a distance of thirty or forty feet away. The captive bird was useless for any critical test. 'Tis true that a bird ten feet in alar dimensions, resting horizontally above one's head thirty feet away, with the clear sky as a background, could be pretty well examined; still a closer position was not only desirable but imperative, and a resort was had to the arts of mimicry with entire success. Procuring a few square yards of thin muslin fabric sufficient to completely envelope my person, it was covered with paint of the green and brown shades so as to resemble the tree tops of localities in the vicinity of either the breeding-places or the roosts of the soaring birds, and barring the unpleasant sensation one has when engaged in the arts of gross deception, I had everything pretty much my own way. Some trouble was experienced in striking the happy mean of scaring the great creatures enough to keep them from alighting on my face, and still not frighten them away, as they were totally oblivious of my presence. Wing movements could now be studied in every conceivable position at leisure, endwise, sidewise, from

above, from beneath, and at every sort of obliquity. The conclusions of observations made from the ground at thirty feet distance were confirmed from the tree-top stations at all distances, from twelve inches upwards. In the first Florida year observations were made with good results about 150 times, during which all the varieties of soaring birds of 100 miles of coast line were viewed. The trees of the country are short and stunted, and easily climbed, and a little search was rewarded by the discovery of thick sturdy tops in which a secure lodgment could be had. The birds abounded in prodigious numbers, thousands occupying a single roosting-ground. Not only was it seen that there was no motion of the wing as a whole, but that there was none of the individual feathers. There was no tremor, no slow nor fast waving; the entire bird moved when the wing did. When the wing was flapped there was no doubt about it, and the flapping could be seen as far almost as the bird was visible. Both the "soaring" and flapping were discoverable when they occurred beyond any doubt whatever. To determine horizontality of the sea-breezes of the coast, a radial arm, feathered and balanced level, was used. It is evident that somewhere in the interior of the peninsula there must be an upward trend of the meeting winds from the Atlantic and Gulf, but there is none discoverable on the western coast. The wind, twenty-five feet above tide, moves uniformly on level lines, and ten feet above the forest tree-tops no upward flow can be found. The lantern of Egmont Light, 150 feet high, at the entrance of Tampa Bay, was frequently used for these atmospheric observations.

There is a wide range in the relation between weight of bird and wing-surface in the different species. It varies from less than one to more than two feet for each pound weight. Uniformly the longer the wing to a given weight the greater the power of translation possessed by the bird, the "man-of-war hawks," in this respect, surpassing all others. Wide, short wings were coupled with heavy bodies, as in the Gannets, and these exhibited slower but steadier flight. The heavier the bird the steadier and easier seemed its movements, and a hungry Vulture, which was very shaky in the breeze, could ride serenely when gorged with carrion.

The only peculiarities discoverable in the atmospheric condition required for soaring, was that the wind in all cases should

move against the bird. The maximum velocity of this meeting of bird and air is unknown to me. I have timed the flight of Frigate-birds through calm air on fixed wings at 100 miles per hour, and their velocity seems to depend on their wishes more than on any limitation of the powers of translation. The minimum speed, however, can be approximated. For the Frigate-bird it is about two miles per hour, three for the Buzzards, and five for the Gannets. The heavier the bird the greater is the minimum velocity required, and a gorged Vulture cannot range itself with a flock of hungry ones, which are sporting in their minimum, without repeatedly flapping its wings.

As soaring is a phenomenon dependent entirely on bird and air, which are not connected with the earth, to avoid confusion it is best to pay no attention to the latter. For instance, a bird motionless in regard to a point on the earth facing a five-mile-per-hour breeze; the same bird moving in calm air at the rate of five miles per hour, or going with the wind at the rate of ten miles per hour, are identical in character so far as soaring is concerned. In each case the wind is meeting the bird at the rate of five miles per hour, and the differences of translation over the earth are accidental, not connected with the mechanical activities of flight.

A bird resting in a minimum breeze cannot fall to the rear without descending; neither can it rise vertically nor at any angle obliquely to the rear. It can draw forward on the air at any speed, and, when the minimum is exceeded, can then fall to the rear or rise until the minimum is once more reached. At the minimum velocity the bird's wings are stretched to their extreme limit, and the angle of inclination is the greatest. As the breeze stiffens, the bird, if it remains in the same place, flexes its pinions and reduces its incline. The Frigate-bird will float in a storm with not more than one-quarter of its wing-surfaces exposed. Sometimes it bends the points of its wings downwards until they meet underneath.

The positions of the stretched wings in regard to a level with the body of the bird also varies. Those of the Frigate-bird will average level, the Buzzards will be above, and the Gannets below a level.

For at least three hundred days in the year these birds could be observed in the air, and when the attention was given to their actions for a considerable time, at all seasons, and in the various

situations found on so varied a coast as that between Tampa Bay and the Capes of Florida, not only the habitual methods common to ordinary soaring flight, but the unusual ones, incidentally performed to meet some emergency, were witnessed. The birds also have periodic seasons of feeling, which puts them on behaviour that in a man would be thought idiotic. The months of February and March, the time of breeding, are prolific in these singular air-tumbling performances. They served to emphasize the complete difference between active and fixed wing-flight.

Being informed by parties from Charlotte's Harbour that Sand-hill Cranes could be found there, I set out in search of them. An outside passage of thirty miles was required, which was safely made, and at nightfall I was among the Gasparilla Keys. The wind being favourable and the weather fair, I kept on the outer beach, and at length drifted through a pass with the swiftly running tide in company with innumerable Sharks, Porpoises, and fish, great and small, all headed for the bay. Rounding the point I threw over the anchor, and, enveloped in a blanket with face towards the stars, slept, as one who manages a small boat for twenty hours can sleep. About daylight I was awakened by the thumping of the mast against the limb of a stunted cedar-tree obliquely jutting from the bank, and while adjusting the trouble a well-known cry sounded far above in the air, which at once banished all desire to sleep. I knew the note quite well. It denoted the arrival of Sandhill or Whooping Cranes from the north. Twenty-five years before I had seen them on the western prairies lift themselves on fixed wings above the clouds, and I had no doubt but what the call proceeded from birds which had the evening before been in the region of the great lakes on our northern boundary. Before sunrise at least fifty had arrived, and were greeted by their comrades on the land in the interior of the Key. They came down in great circles from a height of not less than three miles, on tensely-stretched wings, until within two hundred feet of the earth, when they suddenly began a slow flapping, which continued to the ground. I had often seen them begin their migrations, but never before witnessed the ending. They would average a weight of ten pounds, with about eight square feet of wing-surface. In rising they slowly beat the air until a suitable elevation is reached, when they assume a fixed position, and continue their upward flight in great circles to a

high altitude, when they swing off at a tangent for the south. I have never seen one of these birds move its wings after stopping them in its ascent, until they had arrived at the same level in alighting.

The Buzzards were the best species for observation from the ground. Their patience was simply inexhaustible. I watched a small flock of these birds for fourteen consecutive hours while they floated in the breeze, waiting my removal from a dead Porpoise stranded on the beach. Nothing could surpass the loveliness of the day nor the bland freshness of the incoming breeze. The birds would average eight feet in spread of wings, would weigh six pounds, and have about six square feet of wing-surface. A memorandum-book was filled with notes of the day's experience. About a score of flaps were made between twelve and three o'clock in the afternoon, when the wind was quite active and filled with flaws. From four to six in the evening they were as motionless as if petrified. As the sun disappeared behind the waters of the Gulf I ended the hardest day's work I ever made, and was not fifty feet away before every bird had its beak in the carcase. For several days after this really imprudent exertion of the attention I was abed, but on resuming the subject determined to try an experiment. Before my eyes, assisted by a very good glass, several bodies, of six pounds weight each, had remained stationary in free air about thirty feet above the water, absolutely without any visible support. They had remained in that condition many hours, facing a breeze of velocity varying from five to twenty-five miles per hour. In the rear was located my device for determining horizontality of wind, and it was level the entire day. Most people would be less surprised at a body resting in this way in calm air than in wind. They would hold each to be simply impossible, but more mysterious than both gravity and air-resistance should be ignored than simply gravity. So to determine how much force it would take to keep six pounds in air all the time unsupported I provided a billet of wood of that weight, well rounded, and proceeded to throw it up in still air, and the moment it came down catch and return it. The work was honestly done; the moment it descended it was tossed back with all the activity I was capable of commanding. I prefer that each one should try this for themselves, and will only say that an hour of such work was far, very far, beyond my muscular capacity.

These birds were often watched from a perch in some lonely tree at the water-line. That I could recline at ease in the fragrant foliage of the pine was easily accounted for; the trunk of the sturdy tree antagonised the gravitating force of my body, and I could rest at peace. But what held up the birds? Had gravity ceased to act upon them? Had they no resistance to offer to that sea-born breeze?

After about four years of this kind of work accident favoured me. A summer whirlwind, on a calm morning, issued from among the lemon-trees straggling over the point a few hundred yards below, and, clutching an armful of dead leaves, made for the bay obliquely in front of my station in the tree. A pair of Buzzards were returning from the outer beach on fixed wings, and, as luck would have it, were intercepted by the cyclone; and in five seconds were ducked in the waters of the bay. I hope they possessed a sense of humour, but they seemed to blame me for the mishap. A more thoroughly laughable episode I never witnessed, and from the bottom of my heart forgave the creatures for their seeming injustice. They abandoned that part of the coast, but left their secret behind them. For the purposes of this paper enough has now been said as to the facts exhibited. It is very evident that a state of things has been found to exist which calls for something better than guesswork in way of explanation. Taking the case of a ten-pound bird with tensely-stretched and motionless wings, facing a breeze anywhere from two to one hundred miles per hour, and resting serenely over the same spot of earth, without effort and without fatigue, we find our habitual notions about the difficulty of keeping unsupported substances in the air at fault. We want a solution of the matter from the standpoint of the mechanical engineer. We need not go into the domain of molecular physics for answers, but we wish the bird explained in the same way that the steam-engine is explained when we examine it as a machine doing work. To this end we may ask three questions, and, satisfactory answers being found thereto, the phenomenon will be comprehended:—(1) From whence is derived the motive power to balance gravity? (2) From whence is derived the motive power to hold the bird against the wind? (3) How are these forces applied? To explain a steam-engine in this same sense but two questions demand answer:—(1) From whence comes the motive power to drive the piston? (2) How is this force applied?

When we say that the force which moves the engine comes from the coal that is burning in the furnace, and is conducted through pipes by the medium of steam to a movable piston which it sets in motion, we have in a general way given an explanation to the activities there going on. When we say that the grindstone is operated by the force derived from the muscular organisation of the boy turning it, then its action is also explained briefly.

It is in this way that an attempt will be made to explain a soaring bird. No objection is taken to the view that force cannot produce motion, held by some recent scientists. Granted that nothing but motion can produce motion, and then I am only concerned with the sequence of events; with having it understood that the motion of the piston is not the cause of the burning coal, nor that the grindstone turns the boy.

When the trifling tornado struck the birds, as above related, the mechanical activities going on between bird and air were thrown into confusion, and the gravitating force of the bird's mass instantly carried it to the water. It was evident that the internal adjustments to environing conditions, going on through a line of ancestry reaching to the Reptiles of the secondary age, omitted summer cyclones. They were too rare to count. It was also pretty clear that the gravity of the bird's mass was the source of the entire motive power concerned in the act of soaring.

Were we dealing with wind-mills, sailing-vessels, tornadoes, or any other phenomenon in which the air was one factor and a body connected with the earth the other, the force would properly be spoken of as coming from the air. The amount of force would vary with the velocity of the wind. The work done would be referred to the mechanical agency which set the air in motion. But a body suspended in free air is part of the atmosphere, and at rest with it, unless it employs some activity not derived from it. The same mechanical agent which moves the air equally moves the body. The active birds derive the force to move themselves in the air from their muscular efforts, the soaring birds from gravity. Gravity gives *all* the motive power—that which antagonises itself and that which antagonises air-resistance.

The case is analogous to that of a man on a moving train of cars. He is at rest with the train throughout, unless he employs muscular power to set up motion with it. All activity between

man and car is due to the man's force, and not to the train's force. This force works a pair of legs, which set up motion. Gravity works in a different way. It requires a device which compresses air, as found in the soaring birds.

Notice also that the mechanical action known as "soaring" takes place only between the minimum and maximum velocities with which body and air meet. An initial impulse is required in all cases to carry the body within those limits. In a calm the body would have to be pushed on the air until the minimum was reached. In a breeze it would be forcibly held to reach the same result. The first impulse resembles pushing an engine off of the dead centre. It simply starts the machine. It has nothing whatever to do with its continuous running. Once within the limits of "soaring," the gravitating force of the body gives a liberal supply of power for all the purposes of air-navigation.

Let us suppose the wing-surfaces to be twelve inches in width, and the bird to weigh ten pounds, with wing-expanse sufficient to soar in wind moving at the rate of thirty feet per second horizontally. Why does not the body fall? It is true that there is a stiff wind moving against it horizontally; but the gravitating force is vertical, and can be in no way influenced by a horizontal force. The ball shot from a level cannon falls precisely as fast as one dropped from the mouth of the gun. It is evident that the body is indifferent to the horizontal air. This does not act upon it at all. No particle of air influences it but what is in contact with its surface, and the instant it is in contact it ceases to be horizontal, being deflected in numberless different directions. In a strict sense, in a sense which alone represents the true character of this phenomenon, the air can only be considered as quiescent in every case of soaring. In every case the air is a dead calm until it comes in actual contact with the body, and the movement of the body in the air is a consequence of force derived from the body, and not from the air. It is a parallel case with the boy and grindstone. From the reciprocal nature of action and reaction, the air is doing as much work on the bird as the latter is on the air. The grindstone is doing as much work on the boy as he is on the grindstone, still it would never do to say that the latter turned the boy.

If gravity, then, be the motive power of a soaring bird, how does it act to produce the results? Vertically downwards towards

the centre of the earth, precisely as it does in all other cases, and the reason that the body manifesting it does not get lower is because something is pushing up against the under surface, just hard enough to balance the weight. It may be hard to follow all the peculiarities of the disturbances going on under the bird, but it is certain that they serve to hold it up. They are mainly condensations of air upon which the body is falling, and are equal to ten pounds in each foot of air passing to the rear. This ten pounds of force is moving at the rate of thirty feet per second, as we assumed at the start, and it follows that an amount capable of holding up 300 pounds each second is passing the rear edge of the bird's wings, and is wasted in falling to the tension of the surrounding air.

But this is not all the force of disturbance which passes to the rear. The reactions against air-resistance also go there. These, like the others, consist in condensations, accelerations, and deflections. According to the law of the composition and resolution of forces, they bear the same relation to the vertical disturbances which the height of the incline bears to the base, or, in other words, they are to each other as the angle of inclination of the revolving planes. Supposing in this case the height to be one-fifth the base, there would be 360 pounds of force passing the bird's wing each second. Gravity puts in 300 pounds, and gets itself supported in doing it. The weight is thus balanced; but we are employing an external force of sixty pounds to push the body on the air. By the law of the action of elastic fluids under pressure, when the condensed air passes the rear edge of the wing-surfaces it expands in all directions, and consequently upwards and forwards on that edge. If sixty pounds of the whole 360 expanding is thus thrown forwards, it will balance air-resistance, and the total power to produce the soaring phenomenon will be the weight of the bird. It only requires one-sixth of the whole force on hand to do it. If this can be utilised by wasting the other five-sixths, the task is accomplished. There would be waste in eddies and side-currents, so that in reality there would be less than the total force of disturbance passing to the rear. Allowance may be freely made for all wastage, and sufficient will remain to perform the desired service. Experiment shows that in very critical tests the result can be attained without the rear-expansion. It may be held that each molecule of air as

it is struck by the plane is, to some extent, carried with it, as well as condensed, while those below are at rest. Thus a rotary motion may be supposed to take place on the entire lower surface, when the air-resistant factor would be neutralised by the excess of gravity in each molecule, instead of at the rear edge.

It has been objected that this is a disguised form of "perpetual motion." Remember that there is a great difference between heaping absurdity on a thing and finding absurdity in it. It is urged that gravity can only do work by the fall of the body manifesting it, and that in this case it does not fall; that there is no sacrifice of its energy of position, and hence it cannot do work. This is true of actions in which the earth, or anything fast to or supported by it, is a part, and the gravitating body another part; and it is true in the sense that the word "fall" means getting nearer the earth. But this is not true with soaring, nor with allied phenomena, and I will illustrate the matter by an example. Suppose that our hypothetical bird rest in the air in a horizontal position, and that the wind moves vertically upwards against it at the rate of twenty feet per second. To get the attention on the significant features of the case, we will suppose the bird to weigh the same as the air which it displaces, thus obliterating the gravity factor. It will then have no motion with respect to the air, but will move with it. In this condition it is not a falling body, and is doing no work. It is simply a body resting motionless in air. We will now suppose ten pounds of weight to be added to it. It instantly becomes a gravitating body doing work on the air. Its motion is accelerated until a velocity is reached at which the work done on the air is equal to the force doing it, when its motion becomes uniform. Suppose this to be twenty feet per second. What have we? A case precisely analogous to that of a soaring bird, which is a falling body doing work on the air without losing its energy of position. Its "fall" is properly related, in a strictly scientific sense, to that upon which it is moving, and upon which it is doing work. In relation to the earth, or the moon, or the seven stars, it may be at rest, as they are not even remotely concerned in the matter.

A soaring bird may therefore be considered a machine for distributing air. The motive power required for driving the mechanism is its gravitating force. Its effectiveness consists in

the amount of disturbance which returns to the normal condition of the surrounding atmosphere.

There are two peculiarities connected with its action, which may be considered accidental, or rather incidental, which deserve attention, for they are of the first importance in all questions relating to artificial air-navigation. One of them is, that the material upon which the machine does work becomes the frame which supports it, and which is not connected with the earth in any way. The other is, that while the motion of the device is in all cases in two directions on the air upon which it operates, *viz.*, in the direction of the gravitating force, and at right angles to it, in respect to the earth's surface its motion is in any direction whatever indifferently. These two unique characteristics of soaring constitute its value for artificial use. They are the results of the action of an inclined plane driven on air, and meet the requirements of atmospheric translation completely, so far as the direction of motion and supply of motive power is concerned. It effectually disposes of balloons to antagonise gravity, and of motors to drive the machine against the air. Two requirements are still needed. The device must be steered and kept in position. When it is remembered that the rear expansion drives the bird forward, any change in the extent or position of one wing which is not shared by the other would retard or accelerate the motion of the changed side relatively to the other, and serve to determine the direction of motion. A balance still needs to be preserved. The bird gives significant hints also. The heavier it is the steadier is its motion, and a device large enough to sustain the weight of a man may be qualified by its inertia to assist in preserving its own equipoise.

The most important points of this subject have now been given. Experiments with artificially-induced currents of air, requiring a steam-engine to be transported to the sands of Florida, were expensive, and productive of only negative results. Much time and means were wasted in this way, and all my efforts previous to the summer cyclone above recited seemed abortive, excepting in the settlement of the facts of soaring as shown by the birds. The moment the idea that gravity was the motive power, and not the air, was entertained, the whole matter became luminous. No steps subsequently taken have been in the wrong direction, and I shall return to the prosecution of the subject the moment prudence permits.

The relation of the soaring birds to artificial air-navigation fills the whole subject with a sort of pathos. A Turkey-buzzard, most despised of all the birds, employs mechanical activities by using a device of such simplicity that, compared to it, a common grindstone is a complex machine, for the purposes of air-locomotion in the search for carrion, with conspicuous and complete success, itself being a working model of the very thing which man has worked, and sweated, and died to possess, and he has never seen it! For a period of time coëval with his own existence on this planet this thing has been going on, and the world is full of it now; and still the mature conviction of both common-sense and Science is—that it is impossible.

NOTES AND QUERIES.

MAMMALIA.

Variation of Colour in the Squirrel.—As the habits and colouring of the Squirrel have been discussed a good deal lately, I take the opportunity to mention a few observations I have made. I think Mr. Aplin is right in saying that in some cases the white or light tail is only an individual peculiarity, for on two occasions I have come across nests of young Squirrels, all of which had the tail light-coloured; while one of the parents, in each case, was of the ordinary colour, with a red tail. In Savernake Forest, Wilts, the light-tailed Squirrels seemed to inhabit a regular district, and in this part of the forest I think I hardly ever saw one without a light tail, though they were apparently of all ages. I supposed this to be due in some way to their food. I may mention that the young light-tailed Squirrels had not got light-coloured ears. — A. H. MACPHERSON (51, Gloucester Place, Hyde Park).

Otters near Salisbury. — As there is much interest taken in our few remaining wild animals, the notes I have by me concerning the frequent occurrence of the Otter in this neighbourhood during the last two years may be of interest to the readers of 'The Zoologist.' I can enumerate more than a score of instances happening since the autumn of 1884, and additional proofs, if any were wanted, that the autumn is the usual time for them to drop their young, though perhaps they vary in this respect more than any other animal. On October 8th, 1884, I heard that one of our men, in cutting the sedge by the river-side, had come across three little Otters, newly born, which he had killed and thrown down

on the bank where he had found them. On the next morning I sent for them, and had them preserved to put into an Otter-case in my collection. They were some five or six inches long, quite blind, and covered with soft downy hair, and could not have been more than two or three days old. On March 21st, 1885, the gardener at "The Moat," which has some ornamental water surrounding it, caught a young Otter alive there. On going to see it, I found it to be four or five months old; and during the few days he kept it, it grew comparatively tame, and would eat its boiled eel without fear, while we were watching it. This Otter, I should think, must have been born about the same time as those above mentioned; so that there must have been two litters of them in our meadows at the same time close to one another. The same evening a young Otter was heard crying in "The Moat" water. As there seemed so many about, the keeper thought to try, and shoot the old ones; so that evening, at dusk, he tethered the young one on the middle of "The Moat" lawn, and waited to see if either of the old ones would come to it. He had not waited long before the young one began to cry out sharply, and shortly after one of the old ones appeared, and ran directly across the lawn to where the young one was tethered. The night was so dark, however, that the keeper could not distinguish it properly, and apparently missed it altogether, for it was met not long after making straight for the river by another man, who was nearly thrown down by it, as it ran almost between his legs. I ran out on hearing the shot, and heard the old Otter blowing and snorting on the bank, evidently in anger and fear, but with no accent of pain in the noise it made. The old ones were not seen again. I wrote to the Zoological Society about the young one, and they purchased it; but I am sorry to say it only survived about a fortnight, though it appeared perfectly healthy. On April 23rd I went out to see the Otter-hounds from Cumberland, which were making a week's sojourn in our neighbourhood at Amesbury. We tried the river higher up by Nether-Avon, at Figheledean, but, though the hounds owned the drag of the Otter more than once, we did not actually find. It was indeed asserted by an excited sportsman that he saw the Otter dive off the bank immediately in front of him, but the dogs would in no way own the scent at the spot pointed out by him; and it was no doubt the splash of a moorhen from the bank that had deceived his excited nerves. On the following Saturday, however, at Porton, some six miles east of Salisbury, the hounds had a very successful day, killing two Otters of considerable size. During last summer one of the agricultural students at the college at Downton, some six miles from here, was taking a stroll by the river with his gun, when his attention was attracted by a scuffling in a thick bed of sedges close to him. He remained perfectly quiet, and

presently a fine dog Otter emerged from the rushes, evidently having had the worst in a determined battle with another of his own sex. This one was immediately secured by the sportsman with his first barrel, and immediately after a second made his appearance, which also received his quietus from the second barrel. Each of them, I believe, scaled over 20 lbs. By the keeper's house in the parish a small back stream wends its way to the river hard by, being sheltered by the high hedge of the garden on the one side and by a large faggot-pile on the other, the pile consisting of large logs of timber reaching some five or six feet off the ground, and some bundles of faggots laid on the top of them. One day in November last the keeper heard a curious squealing noise issuing from the pile, and at once divined the cause of it; and in the evening he and the gardener (who had before caught the young Otter alive) set to work and began to pull the pile to pieces to prove the cause of the noise. They had only taken off the uppermost of the faggots when they found three young Otters deposited in a snug little receptacle on the first of the layer of faggots above the timber, some five feet or more above the ground. These they killed, as they were too young to keep, and then proceeded to pull the pile to pieces altogether; and, just before they came to the log nearest the ground, both the old Otters bolted into the water, and though fired at, at very close quarters, they escaped safely down the small stream into the main one. The dog Otter was said to be a very large one indeed, and to have been in our parish for some five or six years; and I am glad to think he is a parishioner still. The instances I have already enumerated will serve to show that the species is not by any means likely to become extinct in our immediate neighbourhood, as our river, the Christchurch Avon, is too deep for hounds to have any real chance of killing them. They are so wary that it is only an occasional one now and then that can be trapped, and, though they have been rather unlucky of late in this parish as to the localities they have chosen in which to deposit their young, yet quite enough remain to keep up the breed for many a long year. I do not suppose, during the twenty-five years I have been in this parish, that a single year has elapsed without one or two instances of their capture having been recorded amongst us. I will not occupy more space in recording instances of their occurrence, except to mention the specimens which have passed through the hands of our local taxidermist, Mr. White, of Fisherton, since the month of August last. During August a fine dog Otter was brought to him for preservation, which had been shot near Codford, weight 25 lbs.; on Sept. 8th, a female, weight 18 lbs., also shot near Swallowcliffe. During the same month another dog Otter was brought in, shot at Sandhill, near Fordingbridge, and a fourth, also a male, weight 25 lbs., from Woodford. In the month of October two young males were brought in from the village of Dinton, above 4 lbs. each; and in November two others about the same weight were

caught in the immediate neighbourhood, a larger one, also a male of 16 lbs., being brought in about the same time, which had been trapped not far from our city; and besides these another pair of young ones, a male and female, reached Mr. White's hands not long after the others I have mentioned. Thus no less than eleven have been sent in for preservation, all more or less from our immediate neighbourhood, since the month of August last, which shows that they are still able to hold their own amongst us. Nay, their numbers are such that they are more likely to cause an irrational fear in weak minds, for on showing the young Otter which had been caught alive to one of my servants, and, at the same time, an old dog Fox, which had on the same day been picked up dead in the parish after a sharp run, she exclaimed, "Lor, sir, I had no idea that there were such creatures about the place! I shall be really now afraid to go out after dark."—ARTHUR P. MORRES (Britford Vicarage, Salisbury).

[We think it very much to be regretted that those in the position of our correspondent, whom we know to be an excellent naturalist, do not use their influence to check the indiscriminate slaughter which is going on of so-called rare animals. Anything more wanton than the destruction of Otters above described, especially of the young ones, which were killed "because they were too young to keep," it would be difficult to conceive. The irrational course adopted by those who pride themselves upon having helped to make a rare animal still rarer by killing every specimen they meet with, is to us inexplicable. We have no objection to Otters being hunted with hounds in a legitimate and sportsman-like manner, because then they have a chance for their lives in an element in which they are much more at home than their pursuers; but we do protest against their being slaughtered in cold blood, or shot at and wounded, whenever they show themselves; and especially do we protest against the unfeeling destruction of the helpless young.—ED.]

The Carnivora of Finland.—How great are still the numbers of carnivorous animals in Finland may be seen from the following figures, given in the last issue of the 'Statistical Yearbook' for Finland:—In 1882 not less than 85 bears, 128 wolves, 407 lynxes, 4005 foxes, 76 gluttons, 240 river otters, 148 martens, 1583 ermines, and 3947 birds of prey were killed, for which the sum of £1646 was paid in premiums by the Government. The ravages occasioned by Carnivora the same year were immense; they are estimated at 274 horses, 846 horned cattle, 5246 sheep, 168 pigs, 119 goats, 1681 reindeer, and 2366 domestic fowls. The greatest number of bears were killed in Viborg and Uleaborg (respectively 33 and 30), whilst most wolves were killed in the more densely-peopled Government of Tavastehus.

Sowerby's Whale on the Yorkshire Coast.—At the meeting of the British Association in September last Professor Turner read a paper on the

occurrence of Sowerby's Whale (*Mesoplodon bidens*) in Shetland, with special reference to the anatomy of the specimen which was dissected and examined by him (Zool. 1885, p. 430). Curiously enough, on the very day on which this paper was read (Sept. 11th), another specimen of this Whale was stranded in shallow water just inside Spurn Head, at a spot known as the Chalk Bank, and was attacked by men in boats, and eventually killed and cut up for the sake of the oil. Unfortunately the remains were allowed to drift out to sea, and were lost beyond possibility of recovery before they could be examined by any competent naturalist. Messrs. Southwell and Eagle Clarke, however, have been at the pains to collect all the information possible, including approximate measurements, from eye-witnesses of the capture, and have published the details in the 'Annals and Magazine of Natural History' for January, 1886 (pp. 53-59). They conclude their remarks with a list of all the specimens (fifteen in number) of this Whale which are known to have been met with since the first recognised example was obtained on the coast of Elginshire in 1800.

BIRDS.

Porphyrio chloronotus and P. cæruleus in the British Isles.—The Greenbacked Porphyrio (*Porphyrio chloronotus*), shot at Horning, in Norfolk, recorded by Mr. Gunn (Zool. 1884, p. 482), is a good specimen, showing not the slightest sign of confinement; but I imagine it is not adult, as the back is not so bright as in one shot some years ago at Barton. I cannot understand why these birds should be always supposed to have escaped, never having heard of anyone in the eastern counties, except ourselves and Mr. Stevenson, who kept them in confinement. They are just as capable of migrating as a Moorhen; moreover, they are migrants in Egypt, and the Purple Gallinule (*P. cæruleus*, *P. veterum* (auct.)) is a known migrant in Spain. I believe I am correct in saying that neither of these species has been as often brought alive to this country as their black-backed ally from Australia (*P. melanotus*), which has never been killed at large. Mr. Gunn's specimen was obtained in the "Broad" district, within a few miles of Barton Broad, where two occurred, and what is very remarkable, they were shot within two hundred yards of the same place. Knowing how often history repeats itself in the matter of rare birds, I think, if this circumstance is viewed fairly, it is very much in favour of these Porphyrios—(which were shot respectively in November, 1877, and August, 1879)—being wild ones. Two or three years ago one of the species under consideration—*P. chloronotus*—was brought into Plymouth, having been taken on board a ship, but in what latitude is not known, and was taken alive to Mr. John Gatcombe, from whom I had this information. It was clearly migrating, and might very likely have reached our shores. Audubon says that, while at the island at Galveston, Texas, he was offered several Martinique Gallinules,—

a well-known South-American species (*Porphyrio martinicus*, Linn.),—by the officers of the 'Boston' frigate, which they had caught on board; and that his friend John Bachmann had received three, which had been caught three hundred miles from land! (Orn. Biog. iv. p. 40). Similar testimony is given in 'North American Birds,' by Baird, Brewer, and Ridgway (vol. i. p. 385). If American Porphyrios are capable of such extended flights, there can be nothing very remarkable in any member of the genus coming to England, their wings having evidently ample power to sustain their bodies in flight. Of the fourteen Porphyrios which have occurred in the British Isles, all but two have occurred in the autumn, the season of all others when we expect rare migratory birds. This in itself is very strong evidence. *P. chloronotus* has occurred on different occasions in Italy and in the South of France, as might be expected: they may have escaped, but we can look with less suspicion on our British ones from the fact of their having occurred also in the intervening countries.—J. H. GURNEY, jun. (Northrepps, Norwich).

Swallow in Co. Sligo in November.—On Nov. 18th, when walking along the shore here at Moyview, I was surprised at seeing a Swallow (a bird of the year) flying about quite lively, notwithstanding the cold weather of that and the three preceding days, when the thermometer indicated an intensity of cold varying from one to six degrees of frost; and on that very morning when the bird was seen the mercury had fallen to twenty-six degrees at half-past seven o'clock. How a Swallow could have existed so long is a mystery, for surely there could have been no food of any sort to be obtained in such a temperature.—ROBERT WARREN (Moyview, Ballina, Co. Mayo).

Variety of the Fieldfare.—I lately examined a pied variety of the Fieldfare, which is so distinctly marked that I think it worth notice. The crown, sides of the head, and neck are white, in some places mixed with a few grey feathers. In one of the wings, the first secondary feather and one or two of the lesser wing-coverts are white, whilst on the other wing one of the greater wing-coverts only is white. The claws, too, are peculiar, having pale bases; otherwise the general coloration is similar to the ordinary male bird. It may be seen with Mr. Allen, bird-preserve, in Feasgate, to whom it was brought from the neighbourhood of York.—J. BACKHOUSE, jun. (West Bank, York).

Winter Nests.—In October I noticed a pair of Sparrows building a roosting nest on the foundation of a spring nest in the top of a pear tree. It was built of hay, and not lined, and the hole in the side seemed to be larger than the hole in an ordinary spring nest. Three birds often appeared at roosting time. I have often observed Sparrows carrying straws into holes in buildings in November. The Wren is known to build roosting

nest, and Rooks may often be seen to repair their nests in autumn. Can anyone give a list of British birds that have been noticed to build or repair nests in autumn?—GEORGE ROBERTS (Lofthouse, Wakefield).

Variation of Plumage in the Corvidæ.—*A propos* to Mr. Theobald's note (Zool. 1885, p. 437) on albino and mottled birds, I may mention that some time ago I saw a Carrion Crow with a white tip to each wing. This was near the town of Bludenz, in the Vorarlberg. Shortly afterwards I observed another Crow, of which only one wing was tipped with white. So far as I can ascertain, albinos or particoloured specimens of this bird are of less frequent occurrence than those of the Jackdaw or Rook.—G. N. DOUGLASS (Bismark Street, Karlsruhe, Baden).

Spoonbill in Co. Kerry.—In a letter of the 14th November last the Rev. Alexander Delap (the Parsonage, Volunteer Island), informed me that a fine specimen of the Spoonbill was shot a few days previously in the harbour there. From the good description given of the plumage the bird was evidently adult.—ROBERT WARREN (Moyview, Ballina, Co. Mayo).

Emberiza melanocephala in Nottinghamshire.—I have in my possession a specimen of the continental Black-headed Bunting, *Emberiza melanocephala*, which was given to me in June or July, 1884, by Mr. Stanley, taxidermist, of Trent Street, Nottingham. This bird was brought to him in the flesh, about the date mentioned, by a man who stated that he had just shot it between Radcliffe and Bingham, in this county. I did not, when I first saw it, know what bird it was, but it has since been identified by Professor Newton, and by Mr. Whitaker, of Rainworth, who both consider its occurrence (I believe for the second time in England) worth recording.—J. RHODES ASHWORTH (The Hutt, Newstead, Nottingham).

[This bird, which is not to be confounded with the Reed Bunting, also known as the Black-headed Bunting, *Emberiza schaniclus*, was first noticed as a rare straggler to England from the European continent by the late Mr. Gould, who, in 'The Ibis' for 1869 (p. 128), reported the capture of a specimen near Brighton, in November, 1868. The species has since been described and figured in the 4th edition of Yarrell's 'British Birds,' vol. ii., p. 64.—ED.]

Glaucous Gull in Skye.—On Dec. 22nd I received a specimen of *Larus glaucus*, obtained in Skye, near Dunvegan, on Dec. 14th. It was an immature bird, and proved to be a female, as the total length of 28 in. and the wing measurement of 16½ in. had led me to anticipate. It was in good condition, the stomach being crammed with the remains of small fishes. When shot it was in company with a larger bird of the same species.—H. A. MACPHERSON (3, Hargrave Road, Upper Holloway).

Notes on Wildfowl in Yorkshire.—Amidst several hundred Mallard, and a few Teal, Widgeon, Tufts, and Pochards (some of the last two bred

from pinioned parents), there are, on the water in this park, two wild Goldeneyes, an immature male and a female, and a fine old female Scaup, which have been here more than twelve months. The Scaup paired with a pinioned male, but, though she remained here, did not nest, as I thought possible. These wild Goldeneyes and the Scaup in hard weather, with other pinioned birds of their kinds, have often dived for maize within half a gun-shot of where I was standing. There is also here a fine wild Greylag, which I first saw on Christmas Day. He was then in company with some tamed Wild Geese of different species, but on the following day he was seen standing away from the others in the most open part of the park. I have full-winged Bean Geese, White-fronted, Pink-footed, and Canada Geese, which seem quite reconciled to the place; but Brent Geese always leave me as soon as their feathers grow. A pair of full-winged Bean Geese nested here last summer. Half the eggs I left with the old goose; the others I placed under a hen. All were addled, except one, from which the hen hatched and reared a fine gosling. These Bean Geese are fairly tame, and will fly to me whenever they expect food, though, from their shabby plumage when I got them two years ago, I considered them wild-caught birds, their flight-feathers being worn down to the stumps, as I have seen in other wildfowl which have been netted and sent over in large quantities from the Continent. I feel certain that a pair of my pinioned Goldeneyes nested here last summer, though I could not discover the nest. The duck disappeared for several weeks in July (I have mislaid my notes giving exact dates), only joining the drake for a short time in the afternoon or evening, when his welcome on her approach, and her hurried way of washing and feeding, left no doubt in my mind that they had a nest in a thick plantation, into which she used to vanish, swimming up a stream that flows through it. After several weeks she ceased to appear at all, and I think must have been taken by a fox, or have died, perhaps, on her nest, as the drake remained on the same pool. I had put up boxes for them, but they were not used by the Goldeneyes, though one was occupied by a Mandarin Drake and a Carolina Duck, both full-winged. Their eggs, which I took, proved addled.—W. H. ST. QUINTIN (Scampston Hall, York).

The Black Redstart in London.—Towards the end of November last, a Black Redstart (*Ruticilla tithys*) made its appearance in the grounds of the Natural History Museum at South Kensington, and remained there until the snow covered the ground on January 8th. It was frequently seen from the windows of the ground-floor rooms, either perched on the railings within a few yards of the windows, or flitting about amongst the shrubs in company with Sparrows and occasionally a Blue Tit. To the credit of the authorities be it said, no attempt was made to convert it into "a specimen" for the British collection, and had it not been for the snow in all probability

the bird would have made a longer stay. It probably succumbed to the cold, or perished from inability to procure proper food.—J. E. HARTING.

Notes from Merionethshire.—Last summer I took a few notes on the birds which I saw in a part of North Wales which is not much frequented, and I hope they may prove of some interest to your readers. The house at which I stayed is about two miles south of Cader Idris, and in front of it, about two hundred yards away, is a little stream which divides the counties of Merioneth and Montgomery. There are a few Buzzards in the district, and on May 13th I took an addled egg from a nest which contained one young bird. It was in the first fork of an old oak, about six feet from the ground, and in it were a snake, a lizard, a mouse, a young blackbird, and half a rabbit. One of our quarrymen told me that he had found another nest with young in it on a rock, but I cannot vouch for the accuracy of this. On the same day I got Ring Ouzel's eggs very hard-set, and on May 14th I found a nest of this bird with young birds in it. On May 31st the quarryman, whom I have mentioned, brought me a young Ring Ouzel from a hill at the back of our house. It could fly well enough to give him a good chase. It seems therefore that these birds must breed here considerably earlier than they do further north, since it is mentioned, in the last edition of Yarrell's 'British Birds,' that Mr. Heysham saw young birds near Carlisle fully fledged on June 15th. The old birds kept flying close to the man till he had got almost to the bottom of the hill. I asked him to take the young bird back. He let it go a little way up the hill, and at its first cry the old ones flew to it in a moment. Grey Wagtails are common here. Two of their nests which I found were lined with white hairs only, and in all of them the lining was composed of lighter-coloured hairs than the rest of the nest. I often went to look at one of these birds sitting on her nest in a ledge of rock almost under a waterfall. There are several pairs of Dippers, and I think there would be many more if they did not build so much under bridges, where the boys easily find the nests and take the eggs for the sole purpose of breaking them. I could not find the eggs of the Common Sandpiper, though I saw several pairs of the birds, and caught four little ones among some rushes. On June 1st I saw and heard a Garden Warbler (*Sylvia hortensis*), and on June 3rd one began to sing in our garden, and continued to do so every day till I left. His favourite place was near the top of a Holm-path. I could not find the nest, though I was anxious to do so, as the bird is not common in Wales. There were several Blackcaps about us, and, on finding a nest in our garden, we hoped it was the Garden Warbler; but while I was taking an egg the parent bird stood on the side of the nest, and showed the unmistakable brown head of the hen Blackcap. Redstarts are very common, and we found many nests, one of them in a hole in a bank. The Pied Flycatcher (*Muscicapa atricapilla*) is by no means rare. We found

six nests of this bird; they are easily found, for the male is continually going to and fro while the female is sitting; and on one occasion there were two males in attendance. We took an egg from one of the nests without disturbing the bird, and she more than once allowed us to push her up from her eggs. This nest was in a hole in the rock on the hill-side, and another one we found in the root of a tree. Wood Wrens (*Ph. sibilatrix*) are, I think, in greater numbers than Willow Wrens (*Ph. trochilus*), and they are certainly more conspicuous. They sing chiefly in the oaks on the hill-sides, and, as the hills are very steep, you can get quite close to them by going rather higher up. We never came across their nests by chance, but we found two by watching the hen bird. The Chiffchaff was by far the scarcer bird of this genus. I only saw two pairs of Red-backed Shrikes; their eggs were beautiful specimens of the two varieties. Of all the summer migrants in this part of Wales, I think Tree Pipits and Wheatears are the most numerous, except perhaps Swifts, which build under the eaves of half the houses in the village. Ravens have built for many years in an old hole in our quarry. The farmers wage war against them, because they kill the lambs and the yearling ewes; but Cader Idris and the Bird Rock will keep the district supplied. Early in December I heard that a new pair had come about the old place in the quarry. There are always a few Curlews on the hills in summer, and I hope next season to go to a place a few miles off, where I am told several pairs breed. There are no game-keepers to destroy the Crows and Magpies, which rear their young quite close to the houses. I have never found Kestrels using their nests here; they seem to confine themselves to the rocks. Many of the common birds are absent; and I have only seen one Starling, and that was five miles from our valley.—F. H. BIRLEY (Dormans Land, East Grinstead).

Egyptian Geese on the River Taw.—Three Egyptian Geese have recently been killed on the River Taw, close to this town. Two were shot on Dec. 28th and one on Jan. 2nd. They were all three together when first seen; doubtless the third bird obtained was the one which got away when the first two were killed. From what I can gather from a boatman, who saw them approaching, they came from a north-westerly direction, and were going south or south-east; they were at a great height, but suddenly came down rapidly to the river not a quarter of a mile above the town. They are very fine specimens, and are being set up by Mr. Rowe, the bird-stuffer of this town. He informs me he has not had one of these birds for quite ten years.—JOSEPH HAMLING (The Close, Barnstaple).

King Eider at the Farne Islands.—On April 25th, 1885, an adult male King Eider, *Somateria spectabilis*, in good plumage, was shot. For several years a male of this rare visitor has been noticed at the Farnes; in 1881 and 1883, when I visited there, he was constantly seen, but was very wild and difficult to approach. He was frequently accompanied by two

ducks, one much darker in colour than the other, which was also considerably smaller; whether females of *spectabilis* or not it is impossible to say; they may have been only the Common Eider, *S. mollissima*. I exhibited this bird in the flesh at a meeting of the Birmingham Natural History Society on April 28th, 1885. The King Eider has been once previously obtained at the Farnes, one, formerly in the collection of F. Raine, of Durham, having been shot there November 13th, 1873.—R. W. CHASE (Edgbaston, Birmingham).

FISHES.

Sturgeon and Sting Ray at Hastings.—During the month of November last a large Sturgeon (*Acipenser sturio*) and a Sting Ray (*Raia pastinaca*) were caught by some fishermen of Hastings. The Sturgeon was taken in a draw-net off Rye; its length was six feet, and its weight ninety pounds. The dorsal plates were very pointed and prominent.—F. V. THEOBALD (Kingston).

MOLLUSCA.

A new List of British Marine Shells.—We have received a list of 'British Marine Shells, comprising those of the Brachiopoda and Mollusca (proper),' which has been compiled by Mr. A. Somerville, B.Sc., F.L.S. The arrangement followed is that of Gwyn Jeffrey's 'British Conchology,' and the list, so far as we have followed it (to the end of the Bivalves), appears to be almost a literal transcript from that work of the families, genera, and species, both in regard to their sequence and the names applied to them. The object of this catalogue, we presume, is to furnish collectors with a check-list, in which they can see at a glance the extent of any genus, or mark off on it such species as they possess or may still desire for their collections. For this purpose it will doubtless be found useful, and, had it been printed on one side of the paper only, and that white instead of tinted, it might also have been utilised for labelling. We have only so far noticed one omission from Gwyn Jeffrey's work, namely, *Neæra rostrata*; but we do not find that Mr. Somerville has included the new species described by that author from the 'Lightning' and 'Porcupine' Expeditions. Some of these species were dredged off the north of the Hebrides and the west of Ireland, and have as much claim to be considered British as several which are quoted in the list as only known from the Shetland Islands and other remote parts of the British Seas. One or two alterations might be suggested in case a second edition of the List should be published. For instance, it has been shown by Stoliczka and others that the term *Pelecypoda* has priority over *Lamellibranchiata*, and Philipsson (not Retzius) should be regarded as the author of *Crania*, as well as of *Unio* (*vide* Brit. Conch. vol. i. p. 31). We would also point out that some of the compiler's names might be differently abbreviated, for as they now stand they are too indefinite.

For example, "Han." for Hancock applies equally to Hanley; "Sch." for Schumacher might mean Schubert; and "Bro." for Brown might also be a contraction for Broderip or Brot. With these amendments, it seems to us, the utility of the list would be enhanced.

Observations on Marine Gastropoda. — I have many kinds of Mollusca in my aquaria, and am studying their habits, and also the causes which tend to produce variation in the forms and colours of their shells. The species are both freshwater and marine, but I shall confine myself in these notes to the latter, and of these shall only remark on the univalves. The most hardy are the specimens of *Littorina littorea*, of which I have a goodly number, in all stages of growth. This common and well-known species breeds very freely in confinement. The young shells are very different in shape to mature ones, being more tapering and slender, with proportionately longer spires. Their shells are brown and semi-transparent, and are several months before they begin to thicken. Possibly they may grow more slowly in an aquarium than in the sea, for some individuals which I specially observed were quite a year before they began to assume the normal shape of the adult. They seem to be long-lived, for one particular specimen, which I introduced into a vase when of a similar size to the average of those exposed for sale in fishmongers' shops, has lived in the aquarium for ten years. The shell has enormously thickened, and become of a greenish-white colour. Judging by the rate at which those have grown which I have had from the egg-state, its age when first introduced could not have been less than ten years, and probably more. It must, then, be upwards of twenty years old now. *Nassa reticulata* and *N. incrassata* I have little difficulty in keeping alive for a long time, although they never breed with me, to my great regret, as I much desire to watch the life-history of both these and other species. They like shallow water best, and spend much of their time out of it altogether, just as the periwinkles do. The food they prefer is a piece of dead mussel, and their sense of smell is evidently very keen, for they soon scent their rations. Their time for feeding is always night, and they are very quiet and apparently asleep in the daytime; but, by taking a light to the aquarium after dark, they may be observed awake and active. In default of a piece of mussel they will eat the flesh of a dead fish or some scraped meat. *Purpura lapillus*, on the contrary, can never be induced to touch the scraped meat I offer them, and I do not succeed in keeping them more than a few months. I have the same difficulty with *Buccinum undatum*. — ALBERT H. WATERS (Cambridge).

The Locality for *Limnæa involuta*, Thompson. — In the 'Journal of Conchology' for September last Mr. Wilfred Bendall writes as follows: — "Cromaglaun Mountain is seven miles from Killarney, on the road to Kenmare. There is no Cromaglaun Lake, as stated by some conchologists.

The tarn inhabited by *L. involuta* is called Lough Crincaum on the one-inch statute map. It is on a boggy plateau immediately under the apex of the mountain, which is a strictly preserved deer-forest. There is no path up, and the climb is a severe one. The pool is apparently not more than twenty feet across, and a quarter of it being situate close against the precipice of the upper mountain is inaccessible. My brother and I spent one hour and a half searching for specimens, but unsuccessfully. I heard afterwards they are only found under stones just where the stream runs out down the face of the mountain, but there are certainly none there at present, as neither the gamekeeper (who knows the shells well) nor ourselves could find them. Perhaps, owing to the unusual heat, they had retired into the mud in the middle of the pool." In the succeeding number (p. 355), Dr. W. H. Evans thus comments on this communication:—"In 'The Naturalist' for November, 1864, I wrote a short account of an ascent of Cromaglaun, and the capture of a dozen of the *Limnæa involuta*, in the summer of that year. I was there in wet weather, while Mr. Bendall was there at the close of the very dry summer of 1884, which circumstance will doubtless account for our different ideas as to the extent of the tarn. He gives it as twenty feet across; when I saw it I feel sure that twenty yards would be much nearer the mark. The hot weather may also have had much to do with his want of success, for it is very possible, as he suggests, that the mollusks might shelter in the mud. Another cause may have operated: when I was there my guide told me that I should have found 'a power more' had I been there a week earlier, but that a gentleman from London had a few days before swept the tarn with a fine net, and secured a great number." He adds:—"This shell, although first described by Mr. Thompson and very properly associated with his name, was discovered by my cousin, the late Dr. W. H. Harvey, for some time Professor of Botany in the Royal Dublin Society, and the author of a well-known work on British Seaweeds, 'Phycologia Britannica.'"

The Resting Position of Oysters.—In books on Conchology, such as Woodward's 'Manual of the Mollusca' and Jeffrey's 'British Conchology,' it is stated that the Oyster rests in the natural state on its left valve, which is the larger and more convex. In this respect it is pointed out that Oysters differ from the animals belonging to the genera *Pecten* and *Anomia*, which rest on the right valve, the *Anomias* being firmly attached by muscle with the flat right valve applied closely to the surface of attachment. In his lecture on Oysters at the Royal Institution, which was published in Nos. 1 and 2 of the 'English Illustrated Magazine,' Prof. Huxley also states that Oysters rest on the left or convex valve, the flat right valve acting as a kind of operculum. Examination of Oysters from the Firth of Forth has convinced me that this statement is erroneous. I do not know on what evidence the current belief of conchologists is founded. The evidence which appears to me conclusive is that the right flat valve is always quite

clean, while the convex valve is covered with worm-tubes, *Styela grossularia*, and Hydroids. The latter are in this connection the most important; it would be impossible for specimens of *Sertularia* and *Thuiaria*, four or five inches long, to grow, as I have found them on almost every Oyster, in the central part of the left valve, if that valve were the lower in position. On examining *Pectens* I found that they resembled the Oyster in the contrast between the surfaces of the two valves, the upper convex one being covered with *Balanus* and other fixed animals, the lower being almost clean. It is generally stated that the *Pecten* lies on its right valve; if this statement rests on the evidence afforded by the condition of the surface of the valves, the same criterion applied to the Oyster leads to the same conclusion, that the right valve is the lower. I have never seen a young Oyster in the attached condition: Huxley states that it is the left valve which is fixed; in papers on the embryology of the Oyster I have not yet been able to find any definite information on the point. Whether it is the right or left valve that becomes attached when the larva assumes the sessile condition I cannot therefore say of my own knowledge, but with regard to the adult Oyster it seems to me certain that the current belief is caused by the repetition of an error. My attention was first called to this point by my assistant, Mr. John Walker, who tells me that the opinion of the fishermen at Newhaven is divided on the point, some saying that the convex valve, others that the flat valve, is the lower. — J. T. CUNNINGHAM (Scottish Marine Station, Granton), in '*Nature*.'

SCIENTIFIC SOCIETIES.

ENTOMOLOGICAL SOCIETY OF LONDON.

January 20, Anniversary Meeting. — ROBERT M'LACHLAN, F.R.S., President, in the chair.

An abstract of the Treasurer's accounts was read by Mr. H. T. Stainton, one of the Auditors; and the Secretary read the report of the Council.

The following gentlemen were then elected as the Council for 1886:— President, Robert M'Lachlan, F.R.S.; Treasurer, Edward Saunders, F.L.S.; Secretaries, Herbert Goss, F.L.S., and W. W. Fowler, M.A., F.L.S.; Librarian, Ferdinand Grut, F.L.S.; other Members of Council, T. R. Billups, Edward A. Fitch, F.L.S., F. Du Cane Godman, M.A., F.R.S., W. F. Kirby, E. B. Poulton, M.A., F.G.S., H. T. Stainton, F.R.S., Samuel Stevens, F.L.S., and J. Jenner Weir, F.L.S., F.Z.S.

The President then delivered an address, and a vote of thanks to him was moved by Mr. Stainton, and seconded by Mr. Pascoe; and the President then replied. A vote of thanks to the Officers was then moved by Mr. Dunning, and seconded by Mr. Distant; and Messrs. Saunders, Fitch, Kirby, and Grut replied.—H. Goss, *Hon. Secretary*.







SPOONBILLS NESTING IN A HERONRY.